Citation:

Ong KK, Emmett PM, Noble S, Ness A, Dunger DB; ALSPAC Study Team. Dietary energy intake at the age of 4 months predicts postnatal weight gain and childhood body mass index. 2006 *Pediarics*. Mar;117(3):e503-8.

PubMed ID: 16510629

Study Design:

Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To determine whether different feeding patterns and energy intakes that are provided to infants affect body weight and Body Mass Index (BMI) later in childhood.

Inclusion Criteria:

Participants were part of the 10% randomly selected subset ("Children in Focus") of the Avon Longitudinal Study of Parents and Children (ALSPAC). ALSPAC is a geographically based cohort study of mothers with expected delivery dates between April 1991 and December 1992 who were resident withing 3 Bristol based health districts of the former county of Avon, United Kingdom.

Exclusion Criteria:

Of the ALSPAC Children in Focus participants, some were excluded if there was not completed dietary records available for them.

Description of Study Protocol:

Recruitment: per the ALSPAC study, participants were recruited through health districts in Avon, United Kingdom while pregnant.

Design: Cohort study using retrospective assessment of data

Blinding used (not applicable)

Intervention: This review of the data focused on infant intake at age 4 months, age of introduction of solid foods and effects on Body Mass Index from birth to 5 years of age.

Statistical Analysis:

- analysis of variance,
- linear regression,
- regression coefficients,
- normal distributions for parametric tests

Data Collection Summary:

Timing of Measurements: data records relevant to this study are birth, 4 months, 1 year, 2 years, 3 years, 4 years and 5 years postnatal.

Dependent Variables

- Breastfeeding, Formula Feeding or Combination of both at 4 months
- Timing of introduction of Solid foods

Independent Variables

Height, Weight, Weight Change, Age, Energy Intake

Control Variables (not applicable)

Description of Actual Data Sample:

Initial and final N: 881 (469 male, 412 female)

Age: birth to 5 years

Ethnicity: not stated

Other relevant demographics and anthropometrics:

	Formula or Mixed Fed Boys (n=321) / Girls (n=261)	Breastfed Boys (n=148) / Girls (n=151)
Birth Weight (kg)	3.553 ± 0.490 / 3.400 ± 0.447	3.601 ± 0.485 / 3.480 ± 0.431
Gestation at Birth (wk)	39.6 ± 1.1 / 39.8 ± 1.2	39.7 ± 1.2 / 39.7 ± 1.2
Weight at 4 month (kg)	6.90 ± 0.74 / 6.40 ± 0.66	6.87 ± 0.82 / 6.26 ± 0.64
Weight gain 0-4 month (kg)	3.34 ± 0.62 / 3.00 ± 0.59	3.27 ± 0.72 / 2.79 ± 0.59
Energy intake at 4 months (kcal/day)	2767.8 ± 478.8 / 2549.4 ± 474.6	2797.2 ± 655.2 / 2574.6 ± 617.4

Location: Avon, United Kingdom

Summary of Results:

Key Findings:

- Boys had larger energy intakes at age 4 months than girls ($p<0.005$ for both breastfed and formula/mixed fed) and this was independent of body weight ($p<0.0001$).
- Increased energy intake was associated with increased body weight at 4 months age for

formula/mixed fed infants but not for breastfed infants.

- Among formula/mixed fed children, energy intake was higher in first born children and in those who had received weaning foods earlier (p=0.002). This was not the case for breast fed infants.
- Higher energy intake at 4 months was associated with greater gains in weight at 1, 2, 3 and 5 years for formula/mixed fed children but not breastfed children.
- Each 420kJ/day increase in energy intake at age 4 months was associated with increased risk for being obese or overweight (BMI > 85th percentile) at 3 years (odds ratio: 1.46, 95% confidence interval: 1.20-1.78) and at 5 years (odds ratio: 1.25; 95% confidence interval: 1.00-1.55) in formula/mixed fed children.

Table showing association between energy intake at age 4 months and change in weight between birth and 1, 2 or 3 years of age.

	Formula or Mixed Fed	Breastfed
0-1 years	0.18 $\pm$ 0.05, p<0.0005	-0.01 $\pm$ 0.04, p = 0.9
0-2 years	0.18 $\pm$ 0.05, p<0.0004	-0.02 $\pm$ 0.04, p = 0.7
0-3 years	0.15 $\pm$ 0.05, p<0.007	-0.02 + 0.04, p = 0.6

Author Conclusion:

Dietary energy intake as early as age 4 months in formula or mixed fed infants was positively related to early childhood weight gain and subsequent body weight and BMI up to 5 years of age.

Dietary energy intake during infancy determines infant weight gain and may influence obesity risk during childhood, at least among formula and mixed fed infants.

Reviewer Comments:

Authors comment on the difficulty of measuring intake in breastfed subjects, the multiple reasons for different feeding behaviors in children and the potential benefit of more than one dietary record data point in further study.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	No
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes

4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	No
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	No
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	No
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	Yes
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes

7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	Yes
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes